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Bpertussis        1 MSRIFNCVKLKREAEGLDFPPYPGELGTRIWQQISKEAWEEWKQIQTRLVNENKLNLADA
Bparapert         1 MSRIFNCVKLKREAEGLDFPPYPGELGTRIWQQISKEAWEEWKQIQTRLVNENKLNLADA
Bbronchi          1 MSRIFNCVKLKREAEGLDFPPYPGELGTRIWQQISKEAWEEWKQIQTRLVNENKLNLADA
A.actin           1 MARMIFCERLKQEAEGLDFQLYPGELGKRIEDSISKQAWGEWMKKQTMLVNEKFLNMMNA
Pmultocida        1 MARTIFCEYLKQESEGLDFQLYPGELGKRIEDSISKQAWREWMKKQTMLVNEKFLNMMNA
Hinfluenzae       1 MARTIFCEYLKKEAEGLDFQLYPGELGKRIEDSVSKQAWGEWIKKQTMLVNEKKLNMMNA
Hducreyi          1 MARMIFCEYLKKEAEGLDFQLYPGELGKRIENSISKQAWAEWIKKQTMLVNEKFLNMMNP
Sputrefasciens    1 MARTINCVHLNKEADGLDFQLYPGDLGKRIEDNISKEAWGLWQKKQTMLINEKKLNMMNV
Vcholerae         1 MARTIFCTRLQKEADGLDFQLYPGELGKRIEDNICKEAWAQWQTKQTMLINEKKLNMMDP
Ecoli             1 MSRTIFCTFLQREAEGQDFQLYPGELGKRIYNEISKEAWAQWQHKQTMLINEKKLNMMNA
O157_H7EDL933     1 MSRTIFCTFLQREAEGQDFQLYPGELGKRIYNEISKEAWAQWQHKQTMLINEKKLNMMNA
O157_H7           1 MSRTIFCTFLQREAEGQDFQLYPGELGKRIYNEISKEAWAQWQHKQTMLINEKKLNMMNA
Spara             1 MSRTIFCTYLQRDAEGQDFQLYPGELGKRIYNEISKDAWAQWQHKQTMLINEKKLNMMNA
Senteritidis      1 MSRTIFCTYLQRDAEGQDFQLYPGELGKRIYNEISKDAWAQWQHKQTMLINEKKLNMMNA
Sdublin           1 MSRTIFCTYLQRDAEGQDFQLYPGELGKRIYNEISKDAWAQWQHKQTMLINEKKLNMMNA
StyphiCT18        1 MSRTIFCTYLQRDAEGQDFQLYPGELGKRIYNEISKDAWAQWQHKQTMLINEKKLNMMNA
Styphimurium      1 MSRTIFCTYLQRDAEGQDFQLYPGELGKRIYNEISKDAWAQWQHKQTMLINEKKLNMMNA
Kpneumo           1 MSRTIFCTFLQREADGQDFQLYPGELGKRIYNEISKEAWAQWQHKQTMLINEKKLSMMNP
Ypesits           1 MSRTIFCTFLKKDAERQDFQLYPGEIGKRIYNEISKEAWSQWITKQTMLINEKKLSMMNI
Buchnera          1 MNRIIFCTFFKKKSEGQDFQSYPGKLGKKIYDQISKKAWEKWIEKQTILINEENLNMFNL
Xfastidiosa       1 MQRIIFCEYEQRDTEGLDFVPYPGELGQKIYACIGKVAWAAWLVHQTMLINENRLSPRNP
Psyring           1 MTRTVMCRKYKEELPGLERAPYPGAKGEDLNNHVSQKAWADWQKHQTLLINERRLNMMNA
Pputida           1 MTRTVMCRKYQEELPGLERPPYPGAKGQDIHEHISQKAWADWQKHQTMLINEKRLNMMNA
Paeruginosa       1 MSRTVMCRKYHEELPGLDRPPYPGAKGEDIYNNVSRKAWDEWQKHQTMLINERRLNMMNA
Ngonorrhoeae      1 MARMIFCVKLNKEAEGMKFPPLPNELGKRIFENVSQEAWAAWTRHQTMLINENRLSLADP
NmeningitB        1 MARMIFCVKLNKEAEGMKFPPLPNELGKRIFENVSQEAWAAWTRHQTMLINENRLSLADP
NmeningitA        1 MARMIFCVKLNKEAEGMKFPPLPNELGKRIFENVSQEAWAAWTRHQTMLINENRLSLADP
Bmallei           1 MARMIHCAKLGKEAEGLDFPPLPGELGKRIYESVSKQAWQDWLKQQTMLINENRLNMADP
Bpseudomallei     1 MARMIHCAKLGKEAEGLDFPPLPGELGKRIYESVSKQAWQDWLKQQTMLINENRLNMADP
Tferrooxidans     1 MSRMIQCVKLGHEAEGLDRPPYPGALGARIYQEVSKEAWQGWLKHQTMLINEYRLSPIDP
Mcapsulatus       1 MARKIICAKLGIEADGLDAPPFPGPQGQRIFEHVSKEAWQDWLKLQTMLINEHRLTPFEA
Cburneti          1 MTRKIICQKLGKEADALNYSPYPGELGERIYNHISEQAWQAWLSHQTMLINEYRLSLIDP
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Fig. 1A

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Bpertussis        61 RARKYLQQQMERELFEDGTVEAQGYVP----
Bparapert         61 RARKYLQQQMERELFEDGTVEAQGYVP----
Bbronchi          61 RARKYLQQQMERELFEDGTVEAQGVP-----
A.actin           61 EHRKLLEQEMVNELFEGKDVHIEGYTPPEAK
Pmultocida        61 DHRQLLEQEMVNELFEGKDVHIEGYVP----
Hinfluenzae       61 EHRKLLEQEMVNELFEGKDVHIEGYVP----
Hducreyi          61 EHRQLLEAEMVNELFEGKDVHIDGYVP----
Sputrefasciens    61 DDRKFLEAQMTSELFEGKDVEIEGFVPE---
Vcholerae         61 EHRKLLEQEMVNELFEGKEVHIEGYTPPAK-
Ecoli             61 EHRKLLEQEMVNELFEGKEVHIEGYTPEDKK
O157_H7EDL933     61 EHRKLLEQEMVNELFEGKEVHIEGYTPEDKK
O157_H7           61 EHRKLLEQEMVNELFEGKEVHIEGYTPEDKK
Spara             61 EHRKLLEQEMVSELFEGKDVHIEGYTPEDKK
Senteritidis      61 EHRKLLEQEMVSELFEGKDVHIEGYTPE---
Sdublin           61 EHRKLLEQEMVSELFEGKDVHIEGYTPEDKK
StyphiCT18        61 EHRKLLEQEMVSELFEGKDVHIEGYTPEDKK
Styphimurium      61 EHRKLLEQEMVSELFEGKDVHIEGYPTEDKK
Kpneumo           61 EHRKLLEQEMVQELFEGK-------------
Ypesits           61 EDRKLLEQEMVNELFEGQDVHIAGYTPPSK-
Buchnera          61 EHRKKLEKYMKLELFK---------------
Xfastidiosa       61 SHRAFLEEELNKELFERRVAKPEGYIEPD--
Psyring           61 EDRKFLQTEMDKELSGEEYAQAEGYVPPEK-
Pputida           61 EDRKFLQAEMDKEFAGEEYAQAEGYVP----
Paeruginosa       61 EDRKFLQQEMDKELSGEDYAKADGYVP----
Ngonorrhoeae      61 RARREYLAQQMEQYFFGDGADAVQGYVPQ---
NmeningitB        61 RARREYLAQQMEQYFFGDGADAVQGYVPQ---
NmeningitA        61 RARREYLAQQMEQYFFGDGADAVQGYVPQ---
Bmallei           61 RARQYLMKQTEKYFFGEGADQASGYVP----
Bpseudomallei     61 RARQYLMKQTEKYFFGEGADQASGYVP----
Tferrooxidans     61 KSRTFLEKQMEAYFFGDGAQSPEGYVP----
Mcapsulatus       61 SARKFLEQEREKELFGGGTSTPQGYVP----
Cburneti          61 KARQFLEQEMINELFGTGSEKPAGYTSE---
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Fig. 1A (continued)

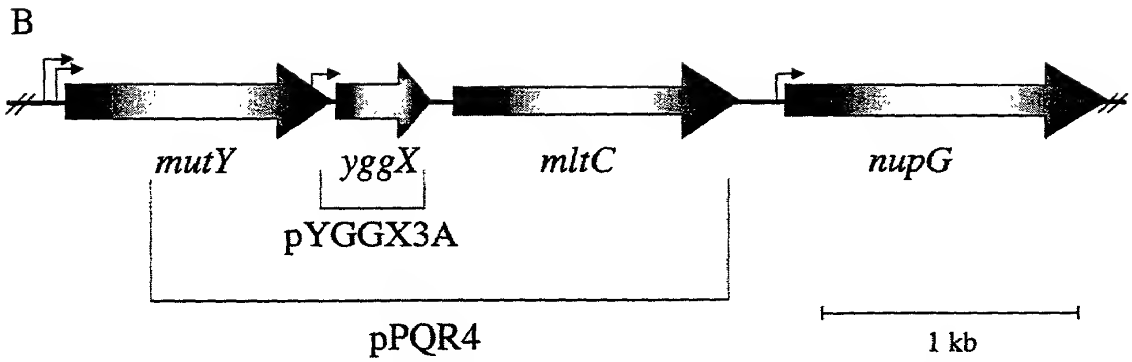

Fig. 1. Physical parameters of *yggX* and its gene product. (*A*) Alignment of YggX homologs. (*B*) Operon structure of *mutY*/*yggX* in *E. coli* and *S. enterica* LT2. Promoters were mapped by Gifford and Wallace in *E. coli* (43).

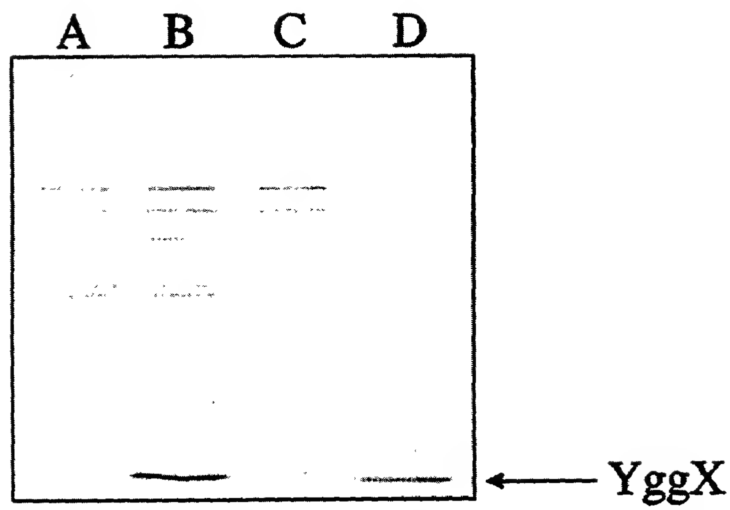

Fig. 2. Increased levels of YggX protein in *yggX** mutant. Western blot analysis was performed according to Harlow and Lane (59). Proteins were visualized by using alkaline phosphatase conjugated to anti-rabbit secondary antibody (Promega). Lanes A–C were loaded with crude cell-free extracts (1 μg protein) from strains DM5104, DM5105 (*yggX**), and DM5647 (*yggX*::Gm), respectively. Lane D was loaded with 1 ng purified YggX.

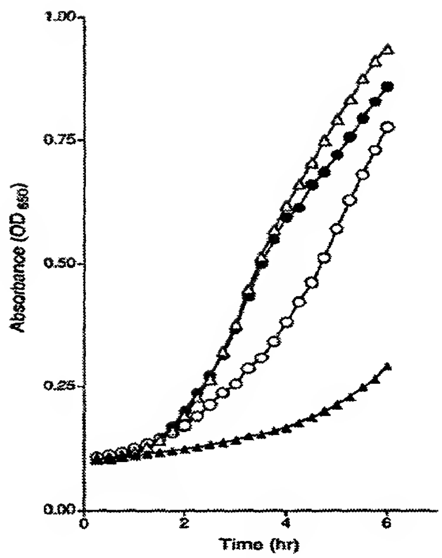

Fig. 3. The *yggX** mutation does not increase MNNG resistance of *gshA* mutants. Strain LT2 was grown in LB with (▲) and without (△) 60 μM MNNG. Both *gshA* (○) and *gshA yggX** (●) mutant strains were grown in LB with 60 μM MNNG.

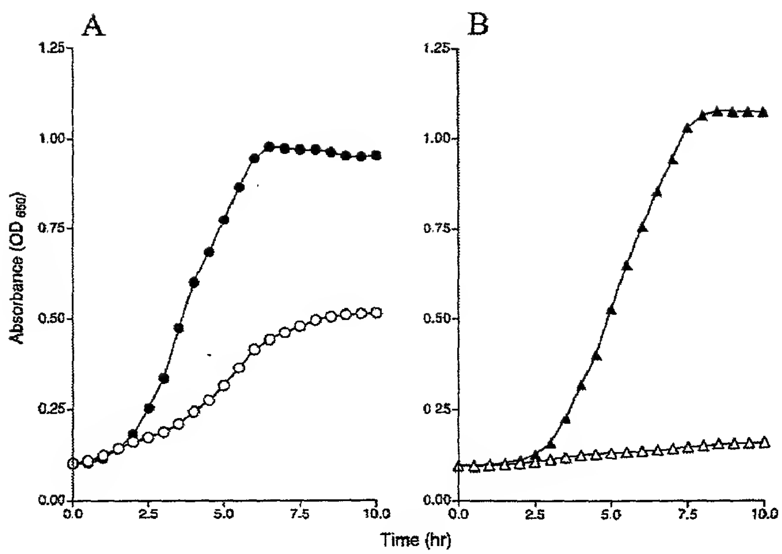

Fig. 4. The *yggX** mutation increases resistance of *S. enterica* to PQ. (*A*) Growth of *gshA* (○) and *gshA yggX** (●) mutant strains in LB with 4 μM PQ. (*B*) Growth of LT2 (△) and *yggX** (▲) strains in LB with 40 μM PQ.

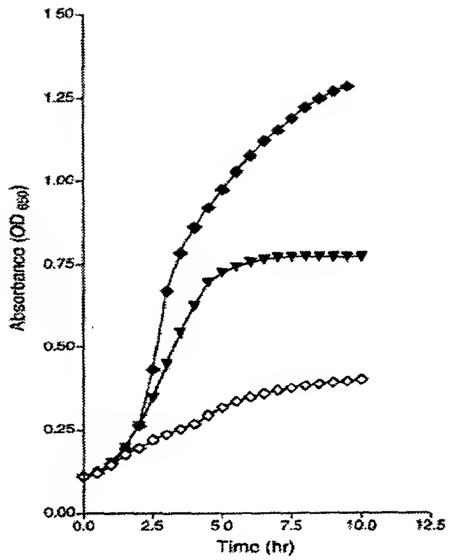

Fig. 5. yggX* does not require soxR to mediate resistance to PQ. Strains LT2 (◆), *soxR* (◇), and *soxR yggX** (▼) were grown in LB with 4.0 μM PQ.

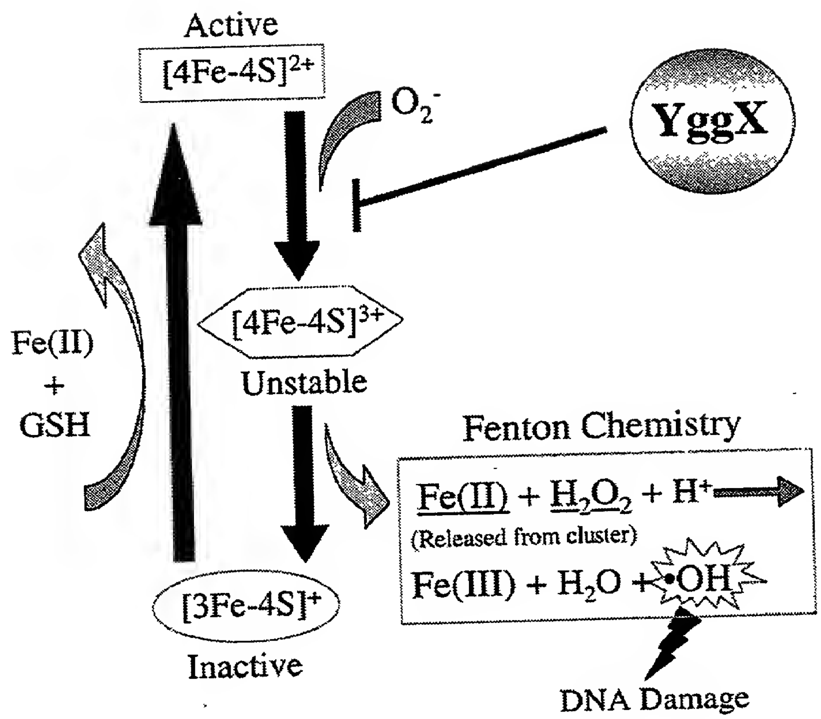

Fig. 6. Model showing how YggX protects *S. enterica* from oxidative damage. The result of superoxide attack on [Fe-S] clusters is depicted. We hypothesize that YggX is able to block oxidative damage to labile clusters and thus prevent the normal downstream consequences of such oxidation.